Collateral and relationship lending in loan pricing: Evidence from UK SMEs

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Abstract: This study investigates how the use of collateral affects incentives for borrowers and lenders and the resulting loan pricing relationship. With data from the UK Survey of Small and Medium-Sized Enterprises 2008, a simultaneous equation approach reveals that high quality borrowers choose contracts with more collateral and lower interest rates, which suggests that collateral acts as an incentive in credit markets. By distinguishing business from personal collateral, the present study also reveals that personal collateral seems more effective as a sorting device, in line with screening models. Regarding the nature of the borrower–lender relationship, a substitution effect arises between relationship length and collateral requirements, but a primary bank uses an explicit loan interest rate as a loss leader to secure long-term rents on relationship business, suggesting the possibility of intertemporal shifting rents.

Keywords: credit rationing, loan pricing, collateral, relationship lending, small and medium-sized enterprises

1. Introduction

Microeconomic theories of banking and financial intermediation [30] explain the widespread use of collateral by noting that collateral reduces credit rationing for under asymmetric information. Theoretical credit rationing occurs in equilibrium if the demand for loans exceeds the supply at the prevailing interest rate [50]. Because banks' expected return increases nonmonotonously with interest rate increases, banks prefer rationing credit to opaque firms (e.g., small and young firms) rather than increasing interest rates [50]. In such situations, collateral provides important means for the bank to mitigate informational asymmetries and solve the credit-rationing problem.

Pledging collateral to secure loans is a common feature of credit acquisition. Cressy and Toivanen [26] report that 85% of UK loans require collateral, as do 70% of US loans [6]. Credit market research explains the use of collateral as a consequence of adverse selection [8] [9] [10] [19], or moral hazard [15] in transactions between borrowers and lenders. The nature of the borrower–lender relationship [43] [46], the level of competition in the credit market [8], and the net cost (benefits) of a through screening of borrowers also might explain the simultaneous existence of secured and unsecured loans [40] (for an extensive research survey, see Coco [22]). However, theoretical and empirical studies on the use of collateral to reduce informational asymmetry do not provide consistent results. The seemingly contradictory results may reflect the research methods, which fail to address simultaneity in debt terms; that is, lenders do not determine the interest rate separately from other loan terms. An analytic framework for price-setting behavior by banks and information availability about small and medium-sized enterprises (SMEs) thus remains underdeveloped [4].

To extend understanding of the pricing behavior of banks, this study investigates how the use of collateral affects incentives for borrowers and lenders and their relationship. First, the present study examines if good borrowers offer collateral to signal their low risk type and obtain a loan contract with a lower interest rate (adverse selection effect) or if riskier borrowers instead must provide collateral (moral hazard effect). Second, this study investigates how borrower–lender relationships affect debt term contracts. Existing literature (e.g., [17], [37]) establishes the endogenous determination of collateral requirements; therefore, the present study examines the main loan contracts terms (i.e., interest rate and collateral requirements) using simultaneous equation modeling. In the context of

SMEs, the owner's personal wealth frequently facilitates access bank loans, so this study also distinguishes business collateral from personal collateral.

2. Relevance

The consolidation of the banking industry and the introduction of the Basel II Capital Accord requires information-opaque firms to rely heavily on collateral [34]. Consolidation increases the use of transaction-lending technologies [5], which depend on particular information, such as financial statements, accounts receivable, inventory, and credit scores. Only SMEs that can provide collateral to secure loan repayment generally receive bank credit [5]. The Basel II Capital Accord should increase the importance of collateral further. The Basel I Capital Accord treated all corporate lending alike; Basel II prescribes that banks that engage in higher risk lending must hold more capital to safeguard their solvency and overall economic stability [3]. Thus banks prefer collateralized loans to reduce loan portfolio risk [3].

Studies of loan collateralization in various countries often rely on banks' credit files (e.g., [1] [2] [6] [17] [26] [27] [32] [36] [38]). This study adopts a data set based on the UK Survey of Small and Medium-Sized Enterprises (UKSMEF), conducted by the Center for Small and Medium-Sized Enterprises (CSME) at Warwick Business School. In turn, by examining interactions among collateralization, interest rate premium, and relationship lending techniques in debt term contracts with SMEs, this study contributes to extant literature in several ways. First, with a simultaneous equation modeling approach, this study examines the simultaneous impact of the borrower–lender relationship on the explicit interest rate and thus on collateral. Accounting for interdependences between contractual debt term conditions may clarify previously ambiguous results. Second, by distinguishing business from personal collateral, this study identifies personal collateral as more effective as a sorting device, in line with screening models. High quality firms prefer to pledge personal collateral, because with this strategy, borrowers can avoid more restrictive usage of business collateral. For the lender, personal collateral is more effective in limiting the borrower's risk incentives, because the owner likely will feel personal consequences of any *ex post* managerial shirking or risk taking. Bonding by personal collateral also avoids more costly monitoring of business collateral or covenants [33] [45].

The next section presents an overview of the role of collateral in mitigating informational asymmetries, which helps solve credit rationing, and develops empirical hypotheses. After a description of the data, variables, and empirical method, this article presents and discusses the results and finally concludes with some key insights.

3. Literature review and hypotheses

3.1 Credit rationing: an overview

Bank loans are the most widely used form of SME financing [29] [53], though exchange relationships often suffer from market imperfections, such as information asymmetries [24] [25] [50] [54] that occur when lenders have little reliable information about the applicants' default risk [8]. Because SMEs rarely are listed firms, they have trouble signaling their qualities to financial institutions [25] [54]. Such firms also may be unwilling to release information, which is time consuming and costly. This dilemma creates the so-called opacity problem [5].

The information asymmetry between banks and SMEs can be severe enough to induce credit rationing, which occurs when demand for loans exceeds supply at the prevailing interest rate [50]. Rationing implies that borrowers either do not receive the full credit they request (type I rationing) or receive no credit at all (type II rationing). Excess demand for bank funds should lead banks to raise loan prices (interest rates), but this tactic is rare in the normal course of bank lending, because banks have no real incentive to raise interest rates when demand exceeds supply. As Steijvers and Voordeckers [49] recognize, the bank-optimal interest rate is the equilibrium interest rate, because above this rate, the bank's expected return increases at a rate slower than the interest rate and even decreases beyond a certain interest rate. Some borrowers that do not receive bank credit would pay a higher interest rate, and a bank that charges this higher interest rate attracts riskier borrowers (adverse selection effect). The adverse selection effect means that the lending bank *ex ante* cannot detect borrower quality, which gives the firm an unfair advantage. If banks raise the interest rate, borrowers prefer even more risky projects, which reduces bank returns further, through the moral hazard effect [49]. Thus even in equilibrium, demand will not equal the supply, and banks prefer to ration credit [50]. Yet theoretical models of the effects of increased loan prices on a lender's portfolio (e.g., [8] [9] [10] [11]) often assume credit

term contracts that include only the terms of the interest rate or collateral, without considering possible interdependences (cf.[22]).

3.2 Joint collateral and interest rate considerations in loan pricing

According to Jensen and Meckling [35], signaling and monitoring can address agency conflict. A solution to the adverse selection problem relies on incentive compatibility contracts with signals about the quality of different agents. Firms that want to signal creditworthiness thus use collateral widely, instead of more costly monitoring tools [51]. To avoid incentive effects though, covenants must be very detailed and cover all aspects of the firm, which is almost impossible. If collateral value is stable or more objectively ascertainable than the distribution of returns, an entrepreneur could trade profitably for better interest rates [19].

A bank that possesses two informative instruments may want to use both jointly, as predicted in screening models (e.g. [8] [9] [10] [11]). Banks simultaneously consider collateral requirements and interest rates to screen investors' riskiness, which supports the use of different contract terms as a self-selection mechanism to separate borrowers with different risk levels. Collateral signals high credit quality in adverse selection situations in which borrowers know their credit quality but lenders do not [19]; borrowers with a higher probability of default instead choose a contract with a higher interest rate and lower collateral.

***H1*:** High quality (low quality) borrowers choose a contract with more (less) collateral and a lower (higher) interest rate.

If lenders can observe the borrower's credit quality *ex ante* [15] but information asymmetry arises after the loan, collateral mitigates moral hazard by limiting the behavior of the borrower [12]. Collateral prevents a firm from switching from a lower to a higher risk project after receiving the loan (i.e., asset substitution [35]) or exerting less effort [15]. Accordingly, lenders ask riskier borrowers to put up more collateral, whereas low risk borrowers obtain loans without having to pledge collateral [6].

***H2*:** High risk firms pledge more collateral than low-risk borrowers.

If an inverse relation marks collateral and interest rates, as a function of the borrower's private information (H1), collateral acts as a mechanism to show the borrower's risk preferences *ex ante*. To measure private information known only by the borrower, this study uses credit quality as a dummy variable, which reflects borrowers' perception of their financial situation (see Section 4.2). The data set lacks information about to *ex post* event defaults, so risk measures reflect firm size [28]. Larger firms tend to be more diversified and have an historical performance track record [18], so this study expects that firm size relates negatively to risk and thus loan collateralization.

A firm that receives more debt attains higher leverage and increases the risk of non-payment [21], leading banks to ask for more collateral protection [27]. Because pledging collateral creates costs that borrowers can recover only with large loans and economies of scale, the likelihood of pledging collateral is higher for larger loan sizes [54]. Long-term debt also gives the borrower more opportunities to alter the project [35], but collateral helps the lender ascertain a certain future value. Even if the company loses its value in the longer term, the collateral retains value [39]. This asset cannot belong to another creditor, so by asking for collateral, the bank ensures the priority of its loan and creates a barrier to other creditors. Thus, loan size and loan maturity period should increase the amount of secured debt.

***H3*:** Loan size relates positively to collateral requirements and negatively to interest rates.

***H4*:** Loan maturity period relates positively to with collateral requirements and negatively to interest rates.

Business and personal collateral could have differential signaling value for agency problems. Business collateral does not expose owners themselves to risk and thus should benefit the firm's owners. John et al. [37] find a positive relation of the use of business collateral, firm risk, and interest rate; for SMEs though, the owner frequently uses personal wealth to access bank loans [1], so personal collateral may be a better signal of quality. The owner of a lower quality firm cannot afford to imitate a high quality firm [17]; in this sense, personal collateral effectively limits the borrower's risk preferences by enhancing the likelihood that the owner suffers the consequences of any ex post managerial shirking or risk-taking activities [39]. Personal collateral also can substitute for equity

investments, and in the case of default, the sale of personal assets could help repay the loan. Therefore this study expects that the economic impact of a requirement to pledge personal collateral should be greater than that of pledging business collateral.

3.3 Impact of borrower–lender relationship strength on loan pricing

Reliable information on SMEs is rare and costly, so relationship lending is an appropriate lending technique [27] [54]. Good lending relationships facilitate information exchange, because lenders invest to obtain information from clients, and borrowers have a motivation to disclose [14]. Over time, an entrepreneur can establish a reputation by demonstrating a preference for low-risk projects and experiencing few repayment difficulties [28], which also grants the bank a more complete picture of the firm's financial health [13].

Measures of relationship strength often focus on duration [41]. A long-term relationship allows a lender to gather more private information about the borrower, such as capacities and character, that is difficult to observe or accumulate [5]. Information generated through repeated transactions and over time also helps reduce the fixed costs of screening and monitoring [14], which can minimize the free-rider problem because the bank internalizes the benefits of investments. The relation between borrower and lender should facilitate ex ante screening and ex post monitoring and mitigate informational opaqueness.

***H5*:** Relationship length relates negatively to collateral requirements.

Scope is another dimension of relationship strength [42], defined as the quantity of products or services the borrower shares with the bank. Concentrated scope increases sources of information for the bank and dilutes information collection costs to enhance economies of scale [28]. The intense interaction and exchange of information reduces information asymmetry, reinforces mutual trust, and minimizes banks' lending risk, which should lead to lower collateral requirements.

***H6*:** The scope of the borrower–lender relationship relates negatively to collateral requirements.

However, a solid relationship may become detrimental to the borrower if a primary lender exerts an information monopoly and charges high interest rates or requires more collateral (i.e., hold-up problem) [46]. Initiating a second lending relationship would be costly for the borrower, which hopes to avoid switching costs and thus gets locked in [14]. In line with Petersen and Rajan's [42] bargaining hypothesis, this study predicts:

***H7*:** Relationship length relates positively to interest rate premiums.

Because collateral reduces a bank's risk exposure, the bank might grow less careful or engage in risky lending ("lazy bank" argument) [40]. Borrowers with lasting relationships with a risky lender then must pay for the losses accrued through an inefficient allocation of resources [38].

4. Data, method, and variables

4.1. Data

The UKSMEF by the CSME started in 2004 with funding from a consortium of public and private organizations, led by the Bank of England. The 2008 survey included 2500 SMEs (from the UK population of 4.4 million), defined as firms with fewer than 250 employees in the private sector.[1] The sample structure supported analyses by size, sector, and government standard regions. These data offer three key advantages. First, the UKSMEF provides information about whether each borrower pledges business or personal collateral to a primary lender, as well as the interest rate premium paid. Second, the survey features various detailed questions about the number of years the borrower and its primary bank conducted transactions and the types of financial services the relationship involves. This information supports analyses of how business and personal collateral and the interest rate premium relate to the borrower–lender relationship. Third**,** the survey includes questions about firms' perceptions of risk levels and the history of past defaults of the firm or owner.

However, data related to the financial statements are scarce. Questions refer to the transactions between a firm and a primary bank, not individual loan contracts. If a firm has multiple loans with a single bank, data about the usage rates of personal and business collateral and the interest rate premium charged may be biased. The survey also does not identify the lender, so this study cannot match firm-level data with financial variables or construct a Herfindahl index. In turn, no control for lender

[1] See UK Data Archive Study number 6314, United Kingdom Survey of Small and Medium-Sized Enterprises Finances, 2008.

characteristics appears. Finally, the UKSMEF survey deals only with surviving firms, though some firms previously defaulted. To analyze price-setting behavior by banks, the chosen data set includes only firms that request bank credit. The final sample for empirical analysis features 326 SMEs.

4.2. Method

Because lenders do not determine interest rates separately from other loan terms [17], this study employs a simultaneous equation method to estimate the separate impacts of each type of collateral on the loan interest rate premium and one another. As collateral and interest rates are jointly determined (e.g., [7] [14] [17]) this means that are endogenously predicted. This situation occurs because the dependent variable (e.g., IRP) may cause the explanatory variables (BC and PC) and if the endogeneity prevails a logit model for BC (and PC) and an OLS regression for IRP provide biased results.

The tests for exogeneity rely on Rivers and Vuong (1988) and Wooldridge (2002), beginning with logit estimations for *BC and PC* and OLS estimation for the *IRP*, with the assumption that debt contract terms are exogenous explanatory variables. We then implement test for exogeneity of *BC* (in the case of the PC and *IRP* equations), PC (in the case of the BC and *IRP* equations) and *IR* (in the case of the *BC* and *PC* equation). The procedure is as follows: First, the OLS approach regresses all possible endogenous variables on all independent and control variables, including instrumental variables, to obtain the reduced form of the residuals. Second, the OLS regression expands to the *IR*P and logit regression to *BC* and *PC* on all exogenous variables, including possible endogenous variables and their instruments, plus the residuals obtained in the first step. If the residual t-statistics indicate insignificance, the results do not reject the null hypothesis that the contract terms are exogenous. If one (or both) contract terms is endogenous, the study checks the validity of the instrumental variables by regressing the instrumented variable on instrumental variables. Instrumental variables should correlate with the focal endogenous variable but not with other endogenous variables or the error term. Finally, the fitted values become independent variables in the equations in the case of presence of endogeneity [44]. In this case, the OLS model is replaced by a 2SLS model and the logit model is replaced by an instrumental logit model.

If accepted the exogeneity of variables: the IRP equation use OLS; logit model is adopted for BC and PC dependent variables. In this case, the equation system s is as follows:

$$\mathbf{IRP} = \alpha_{IRP} + \lambda_{IRP}X + \varphi_{IRP}W + \varepsilon_{IRP} \quad (1)$$

$$\mathbf{BC} = \alpha_{BC} + \lambda_{BC}X + \varphi_{BC}W + \varepsilon_{BC} \quad (2)$$

$$\mathbf{PC} = \alpha_{PC} + \lambda_{PC}X + \varphi_{PC}W + \varepsilon_{PC} \quad (3)$$

The specification differentiates a vector of independent variables (X) which includes BC and PC (IRP) for IRP (BC and PC) dependent variable and a vector of control variables (W).

If rejected the exogeneity of variables, the simultaneous system of equations is as follows, i.e. the system included the fitted value of the of the endogenous variables ($\widehat{IRP}$;$\widehat{BC}$;$\widehat{PC}$):

$$\mathbf{IRP} = \alpha_{IRP} + \beta_{IRP}\widehat{BC} + \delta_{IRP}\widehat{PC} + \lambda_{IRP}X + \varphi_{IRP}W + \phi_{BC}Z + \phi_{PC}Z + \varepsilon_{IRP} \quad (4)$$

$$\mathbf{BC} = \alpha_{BC} + \beta_{BC}\widehat{IRP} + \delta_{BC}\widehat{PC} + \lambda_{BC}X + \varphi_{BC}W + \phi_{IRP}Z + \phi_{PC}Z + \varepsilon_{BC} \quad (5)$$

$$\mathbf{PC} = \alpha_{PC} + \beta_{PC}\widehat{IRP} + \delta_{PC}\widehat{BC} + \lambda_{PC}X + \varphi_{PC}W + \phi_{IRP}Z + \phi_{BC}Z + \varepsilon_{PC} \quad (6)$$

For each (potential) endogenous variable, simultaneous system of equations employs specific instruments (Z) and relies on instrumental variables to measure the independent variables. The specification also differentiates a vector of independent variables (X) and a vector of control variables (W).

4.3. Variables

4.3.1. Dependent endogenous variables.

The dependent variables are interest rate premium (IRP), business collateral (BC), and personal collateral (PC). The IRP is the difference between the contractual interest rate and the prime rate [7] [17]. BC and PC are dummy variables that equal 1 if the borrower pledges business collateral or personal

collateral, respectively. Table 1 contains all the variable definitions.

4.3.2. Independent and control variables.

The independent variables reflect firm, loan, and borrower–lender relationship characteristics. Firm variables include credit quality (H1) and firm size (H2). The UKSMEF database defines a binary dummy variable as equal to 1 if the firm shows little financial distress, which is somewhat subjective because each respondent defines its own final situation. This study uses "credit quality" as a proxy for private information, which the lender does not have or knows only imperfectly. Literature suggests that firm size is one of the most relevant input in the credit risk assessment (e.g., [48]). Hence, this study includes "firm size", that is the natural logarithm of the firm's total assets, to predict the loan price terms.

Loan characteristics include "loan size" (H3) (i.e., natural logarithm of loan size, measured in pounds), "loan maturity" (H4) (i.e., natural logarithm of loan maturity in years), a binary variable ("fixed rate") that controls if the loan has a fixed rate [17], and the fitted values for collateral requirements and interest rate premium, obtained from an instrumental variable technique.

For the borrower–lender variables, this study includes relationship "length" (H5, H7) with the main bank (i.e., natural logarithm of the number of years the firm has dealt with its main bank) and variable "scope" (H6), or the number of financial products the borrower has purchased from the primary bank [20]. The UKSMEF asks firms to list all products/services, other than loans, they have purchased. The measure is the number of products for each firm, divided by the total products offered by the primary bank.

Finally, this study controls for industry and organizational form considering that there are differences in the risk exposure across different activity sectors [48] and organizational legal status [7]. Nine dummy variables account for industry differences. To capture possible differences in collateral requirements, this study features four dummy variables for firm organization: S-corporation, C-corporation, limited liability company, and limited liability partnership.

Table 1: Variable definitions

Variable	Definition
Dependent variables	
IRP	Difference between the contractual interest rate and the prime rate
BC	Equals 1 if the firm is required to post business collateral (0,1)
PC	Equals 1 if the owner is required to post personal collateral/guarantees (0,1)
Independent variables	
Credit quality	Equals 1 if the firm show a low level of financial distress (0,1)
Firm size	Natural logarithm of firm's total assets
Loan size	Natural logarithm of the loan size measured in pounds
Loan maturity	Natural logarithm of the loan maturity in years
Fixed rate	Equals 1 if the loan has a fixed rate (0,1)
Length	Natural logarithm of the relationship length in years with the main bank
Scope	Number of financial products the firms has purchased from the main bank
Control variables	
Industry	Equals 1 it the firms belongs to industry x (x ϵ [1,9] to distinguish between 9 industries) (0,1)
S-corp.	Equals 1 it he firm is organized as a S-corporation (0,1)
C-corp.	Equals 1 it he firm is organized as a C-corporation (0,1)
LLC	Equals 1 it he firm is organized as a limited liability company (0,1)
LLP	Equals 1 it he firm is organized as a limited liability partnership (0,1)
Instrumental variables	
Firm delinquency	Equals 1 if the firms has previously defaulted (0,1)
Fixed assets	Equals 1 if the loan must be supported by a compensating balance sheet assets (0,1)
CEO age	Natural logarithm of the age of the CEO in years

4.3.3. Instrumental variables

The instrumental variable in the interest rate premium equation is firm delinquency, a dummy equal to 1 if the firm has previously defaulted and 0 otherwise. Bank uses past information to classify current customer as good or bad customer [23]. Hence, the likelihood that a lender imposes a higher interest rate should relate positively to whether the firm has defaulted previously [31]

For the bank, collecting information about small firms is costly [45], so banks rely on the use of collateral requirements, especially fixed assets with

Table 2. OLS estimation for interest rate premium/logistic estimation for business and personal collateral and exogeneity tests

Panel A: OLS and logistic estimations									
	IRP (OLS)			BC (LOGIT)			PC (LOGIT)		
	Coef. (1)		T-stat.	Coef. (2)		Wald-test.	Coef. (3)		Wald-test.
IRP				-0.006	(0.058)	0.012	0.031	(0.063)	0.244
BC	0.024	(0.312)	0.077				-1.778	(0.406)	19.189***
PC	0.155	(0.344)	0.451	-1.734	(0.419)	17.108***			
Credit quality	-0.224	(0.278)	-0.804	0.571	(0.281)	4.135**	0.144	(0.302)	0.226
Firm size	-0.150	(0.084)	-1.794*	0.254	(0.087)	8.566***	-0.150	(0.091)	2.733*
Loan size	-0.358	(0.121)	-2.949***	0.299	(0.139)	4.653**	0.323	(0.151)	4.553**
Loan maturity	0.074	(0.210)	0.354	0.699	(0.229)	9.310***	0.237	(0.233)	1.030
Fixed rate	2.493	(0.284)	8.786***	-0.384	(0.328)	1.372	-0.636	(0.362)	3.085*
Length	0.247	(0.139)	1.781*	0.131	(0.145)	0.817	-0.127	(0.159)	0.634
Scope	0.146	(0.774)	0.189	-0.631	(0.824)	0.586	-0.079	(0.862)	0.008
Firm	0.864	(0.333)	2.595***						
Fixed assets				0.525	(0.278)	3.559*			
CEO age							1.318	(0.737)	3.198*
Constant	8.871	(1.461)	6.073***	-9.431	(1.865)	25.560***	-8.306	(3.222)	6.644***
Obs.		326			326			326	
R-squared/Log-Likelihood		0.322			329.615			288.709	
Panel B: Exogeneity Tests									
resid_IRP				1.51	(1.422)	1.127	-1.986	(0.907)	4.791**
resid_BC	0.745	(1.554)	0.479				39.112	(6.847)	32.633***
resid_PC	-13.320	(2.788)	-4.778***	329.102	(124.817)	6.952***			

Standard errors are reported in parentheses. This study controls for industry (nine dummy variables) and organizational form (four dummy variables), but the results do not appear in this table. *** Statistically significant at 1% level.** Statistically significant at 5% level. * Statistically significant at 10% level

relatively stable value, that also signal the bank's priority among creditors [14]. Securing credit limits a firm's ability to obtain future loans from another lender and mitigates the possibility of selling business assets to invest in new projects [47] or perks [37]. Thus, the business collateral equation uses the fixed assets variable as an instrumental variable equal to 1 if the loan requires support from a compensating balance sheet fixed asset, and 0 otherwise. However, Mann [39] argues that personal collateral is more effective in limiting a borrower's risk incentives by increasing the likelihood that the owner suffers the consequences of ex post managerial shirking. For the personal collateral equation, this study uses the natural logarithm of the age of the CEO/owner as an instrumental variable. Younger borrowers provide scant information in commercial and financial records; over time, information accumulates [28] [23]. The study follows Bolton [16] to assume that small businesses feature the same individual and/or family ownership.

The tests for exogeneity rely on the method of Rivers and Vuong [44] and Wooldridge [52], beginning with OLS estimations for the IRP variable and logit estimations for BC and PC, with the assumption that debt contract terms are exogenous explanatory variables. First, the OLS approach regresses all possible endogenous variables on all independent and control variables, including instrumental variables, to obtain the reduced form of the residuals. Second, the OLS regression expands to the IRP and logit regression to

BC and PC on all exogenous variables, including possible endogenous variables and their instruments, plus the residuals obtained in the first step. If the residual t-statistics indicate insignificance, the results do not reject the null hypothesis that the contract terms are exogenous. If one (or both) contract terms is endogenous, the study checks the validity of the instrumental variables by regressing the instrumented variable on instrumental variables. Third, the fitted values become independent variables in the IRP rate, BC, and PC equations.

5. Results

5.1. Descriptive analysis

Appendix contains the focal descriptive statistics and correlations, though not for the control variables. Whereas 36% of firms pledged BC, 21% pledged PC, and the mean IRP is 4.35% (median = 5%). At the mean, firms have 1,519,540 in total assets, and 58% of firms self-identify as low risk borrowers. Average relationship length with the main bank is 14.5 years, and firms purchase more than 50% of their financial services (scope) from this main bank (mean = 55%). Regarding loan characteristics, the mean value of loan size is 546,074 pounds, with a maturity of 9.6 years, and 40% of firms negotiate fixed rates.

The correlation values for the independent variables are less than 0.5, so multicollinearity was not a problem [52]. The Spearman correlations for the coefficient estimation provide a non-parametric technique based on ranks rather than the value of the variables.

5.2. Empirical results

Panel A of Table 2 contains the benchmark estimation (i.e., OLS for IRP, logistic estimation for BC and PC) when all the loan contract terms are exogenous variables. The coefficients of the two collateral variables do not relate to the IRP variable (Equation 1). Thus explicit and implicit prices of loans do not appear jointly determined ([17]). The coefficients of the PC (1.734, Equation 2) and BC (-1.778, Equation 3) variables are negative and statistically significant at 1%. That is, BC and PC are substitutes, and SMEs can offer either business or personal collateral to gain loan approval.

Panel B summarizes the exogeneity tests for the dependent endogenous variables. The t-statistics of the residual terms of the first step for BC and PC indicate rejection of the null hypothesis that PC is exogenous but not of the null hypothesis that business collateral BC is (Equation 1). For BC (Equation 2), the t-statistics of the residuals from PC are statistically significant at the 1% level, rejecting

Table 3. Validation of Instrumental Variables

	IRP (OLS)				BC (LOGIT)				PC (LOGIT)			
	IV only		IV, Independent and Control variables		IV only		IV, Independent and Control variables		IV only		IV, Independent and Control variables	
	(1)		(2)		(3)		(4)		(5)		(6)	
	Coef.	p-value	Coef.	p-value	Coef.	p-value	Coef.	p-value	Coef.	p-value	Coef.	p-value
Credit quality			-0.219				0.533	**			-0.022	
			(0.276)				(0.271)				(0.288)	
Firm size			-0.154	*			0.298	***			-0.249	***
			(0.081)				(0.084)				(0.087)	
Loan size			-0.351	***			0.256	*			0.276	*
			(0.119)				(0.134)				(0.144)	
Loan maturity			0.079				0.694	***			0.072	
			(0.205)				(0.226)				(0.229)	
Fixed rate			2.479	***			-0.258				-0.483	
			(0.281)				(0.277)				(0.314)	
Length			0.246	*			0.129				-0.145	
			(0.138)				(0.137)				(0.152)	
Scope			0.144				-0.476				-0.080	
			(0.772)				(0.790)				(0.827)	
Firm delinquency	1.383	***	0.865	***								
	(0.377)		(0.332)									
Fixed assets					0.799	***	0.605	***				
					(0.239)		(0.267)					
CEO age									0.909	*	1.361	*
									(0.534)		(0.737)	
Constant	4.053	***	8.881	***	-1.030	***	-9.916	***	-4.831	**	-6.506	**
	(0.175)		(1.417)		(0.184)		(1.781)		(2.089)		(3.152)	
Obs.	326		326		326		326		326		326	
R-squared	0.040		0.322									
Log-Likelihood					414.117		351.262		326.943		312.925	

Standard errors are reported in parentheses. This study controls for industry (nine dummy variables) and organizational form (four dummy variables), but the results do not appear in this table. IRP OLS estimations report the p-value for the t-test. . BC and PC Logit estimations report the p-value for the wald-test. *** Statistically significant at 1% level. ** Statistically significant at 5% level. * Statistically significant at 10% level

Table 4. Simultaneous system equations

	IRP (OLS)			BC (LOGIT)			PC (LOGIT)		
Instrumented variables	PC			PC			IRP and BC		
Instrumental variables	CEO age			CEO age			Firm delinquency and Fixed Assets		
	Coef. (1)		T-stat.	Coef. (2)		Wald-test.	Coef. (3)		Wald-test.
IRP				1.622	(0.699)	5.387**	2.142	(0.883)	5.886**
BC	3.122	(0.714)	4.371***						
PC	13.266	(2.760)	4.806***	-295.572	(109.83	7.242***	-38.679	(6.569)	34.667***
Credit quality	-0.6478	(0.283)	-2.290**	10.163	(3.509)	8.390***	4.092	(1.076)	14.453***
Firm size	0.164	(0.104)	1.577	-6.355	(2.374)	7.163***	1.977	(0.457)	18.717***
Loan size	-0.965	(0.173)	-5.588***	15.695	(5.825)	7.261***	2.663	(0.608)	19.155***
Loan maturity	-0.423	(0.227)	-1.859*	14.518	(5.188)	7.832***	3.690	(0.743)	24.660***
Fixed rate	3.739	(0.378)	9.892***	-31.613	(11.719)	7.277***	-9.464	(2.824)	11.232***
Length	0.344	(0.135)	2.538**	-3.308	(1.361)	5.906**	-0.319	(0.467)	0.467
Scope	0.347	(0.749)	0.463	-9.169	(5.463)	2.817*	1.582	(2.221	0.507
Firm delinquency	0.907	(0.322)	2.820***						
Fixed assets				1.815	(1.513)	1.439			
CEO age							0.297	(0.609)	0.238
Constant	9.120	(1.411)	6.462***	-110.992	(42.318)	6.879***	-67.056	(14.572)	21.175***
Obs.	326			326			326		
R-squared/ Log-Likelihood	0.368			27.250			58.728		

Standard errors are reported in parentheses. This study controls for industry (nine dummy variables) and organizational form (four dummy variables), but the results do not appear in this table. *** Statistically significant at 1% level. ** Statistically significant at 5% level. * Statistically significant at 10% level

the null hypothesis that PC is exogenous but not that IRP is. In Equation 3, the t-statistics of the residuals for IPR and BC are both statistically significant (5% and 1% level, respectively). Accordingly, this study rejects the null hypothesis that these variables are exogenous in relation to PC.

The comparative results in Table 3 reveal the validity of the instrumental variables for each equation. The coefficient of the instrumental variable for IRP (i.e., firm delinquency) is positive and statistically significant at 1% in the first specification (Equation 1). Including the independent and control variables in the second specification produces the same results (Equation 6). Thus, borrowers with a delinquent history pay a higher interest rate [31]. The third specification shows a positive and statistically relation between fixed assets (instrumental variable for BC equation) and BC variables. The results remain unchanged after the inclusion of independent and control variables (fourth specification). This finding is unsurprising; fixed assets can work as collateral directly, and banks can gauge the market value of fixed assets more easily than that for intangible assets. The fifth specification assesses the performance of the CEO age instrumental variable in the PC equation. This variable (.909) is positive and statistically significant at the 10% level, so in SMEs, collateral availability likely depends on the borrower's personal wealth, which increases with his or her age. Finally, the instrumental variable for IRP (firm delinquency) does not correlate with other potential endogenous variables, nor do fixed assets and CEO age correlate with other variables (see Appendix1 – correlations and Appendix 2 – univariate tests).

The simultaneous system of equations, based on two-stage least squares estimations, produces the results in Table 4. For the first-stage IRP regression, the logistic regression features PC on all independent, control and instrumental variables. The fitted values represent the independent variables in the IRP equation. Parallel regressions produce the BC and PC results in Table 5.

The BC and PC endogenous variables are statistically significant (1% level) in the IRP equation (Equation 1). The positive sign in the simultaneous estimation suggests that posting collateral controls for and implicitly prices (some) of the loss exposure lenders face. The results from the collateral equations show that the coefficient of the IRP variable is positive and statistically significant (5% level) in both collateral equations (BC 1.622, PC 2.142). These results suggest the joint determination of debt contract terms, such that borrowers that pay higher interest rates are more likely to have a collateralized loan [17]. Table 4 also shows a significant substitution effect at the 1% level between collateral forms (see Equations 2 and 3). The coefficient of the credit quality variable (proxy for private information) is positive and statistically significant at the 1% level in both collateral equations (BC 10.163, PC 4.092), whereas for the IRP equation, the coefficient of the variable is negative (-0.648, significant at 5%). In agreement with Jimenez et al. [36], the results support the H1; indicating that high quality borrowers choose a contract with more collateral (business or personal) to obtain a low interest rate. In Table 2, this variable has the same sign but is positive and statistically significant only at 5% for the BC equation.

Regarding size, the proxy for observable risk [28], Table 4 reports a negative and statistically significant coefficient at the 1% level (-6.355) in the BC equation but a positive coefficient (1.977, significant at 1%) in the PC equation. For the interest rate, the coefficient is positive (.164) but not statistically significant. In contrast, in Table 2 firm size is statistically significant at 1% level but with the opposite sign (i.e., positive) for BC and marginal in the IRP and PC equations. These results indicate that lenders ask high risk borrowers to pledge more collateral, but only good borrowers are willing to do so. Good borrowers also appear to prefer to pledge PC instead of BC [2] to reduce restrictions on their resource usage and employ them in profitable projects. That is, PC acts as an effective sorting device [8] [10]. Accordingly, these results support partially the H2.

The likelihood of collateral also depends on the loan characteristics (e.g., [54]). Loan size relates positively to both types of collateral and negatively to the IRP variable (all significant at 1%). Loan maturity indicates similar results. The benchmark estimation in Table 3 is qualitatively similar, except for the weaker significance of loan maturity in the IRP and PC equations. In accordance with Cressy and Toivanen [26] and in support of H3 and H4, collateral has implications for the cost of borrowing.[2] Borrowers are more likely to pledge collateral to receive a lower interest rate, as predicted by signaling theory [10].

Loan maturity and loan size could be endogenous variables [17]. However, data limitations prevent the identification of relevant instruments that would not also correlate with the interest rate premium and collateral variables. This study therefore tests the impact of the independent variables when the equations exclude loan maturity; the results of the three regressions do not change materially (results available on request).

Finally, relationship length reveals a negative coefficient (-3.308, significant at 5%) in the BC equation, whereas in the PC equation, the result is not statistically significant. For scope, the results prove significant at weak levels, qualitatively the same as in the benchmark estimation (Table 2). These estimates partially support H5 and H6, which suggest a substitution effect between relationship length and BC requirements, and confirm Steijvers and Voordeckers's [50] prediction that relationship length decreases the likelihood of pledging collateral. According to Han et al. [31], a longer relationship could be an adverse selection device that substitutes for the role of collateral, yet the present study indicates that a long-term relationship with a bank exerts a positive effect on IRP charges (.344, significant at 5%), in line with Petersen and Rajan's [42] bargaining hypothesis.[3] The IRP increase over the duration of a lender–borrower relationship also suggests "inter-temporal shifting of rents is possible" ([27], p. 107).

5.3. Robustness tests

The UKSMEF survey does not indicate if a bank seeks collateral from the borrower before issuing the most recent loan or if the borrower offers collateral. Furthermore, without information about borrowers that default, this study can only assess the signaling role of collateral indirectly. To verify the main conclusions, this section reports on the tests of several interaction variables. The first (INTER1)

[2] Large loans likely feature collateral because they benefit from scale economies, given fixed monitoring costs [35] [45]. This feature is consistent with the finding that owners that post more collateral can borrow large amounts but also could imply a transaction effect because large loans are riskier.

[3] Baas and Schrooten [4] show that relationship lending leads to relatively higher interest rates than other lending techniques, such as transaction-based lending (see also [54]).

Table 5. Robustness test

	IRP (OLS)			BC (LOGIT)			PC (LOGIT)		
Instrumented variables	PC			PC			IRP and BC		
Instrumental variables	CEO age (1)			CEO age (2)			Firm delinquency and Fixed Assets (3)		
	Coef.		T-stat.	Coef.		Wald-test.	Coef.		Wald-test.
IRP				0.272	(0.175)	2.409	2.919	(1.054)	7.672***
BC	2.631	(0.672)	3.914***				-47.839	(9.420)	25.789***
PC	11.347	(2.619)	4.333***	-45.998	(12.033)	14.612***			
INTER1	-0.627	(0.260)	-2.410**	1.385	(1.483)	0.872	3.342	(1.198)	7.789***
Firm size	0.086	(0.099)	0.863	-0.838	(0.339)	6.125**	2.820	(0.680)	17.185***
Loan size	-0.906	(0.168)	-5.400***	2.747	(0.782)	12.346***	3.537	(0.823)	18.453***
Loan maturity	-0.286	(0.223)	-1.283**	3.130	(0.883)	12.576***	4.236	(0.917)	21.342***
Fixed rate	3.601	(0.371)	9.711***	-5.701	(1.643)	12.031***	-12.790	(3.704)	11.921***
INTER2	0.067	(0.038)	1.775*	-0.246	(0.120)	4.201**	-0.187	(0.125)	2.248
Scope	0.540	(0.742)	0.728	-2.424	(2.556)	0.899	1.552	(2.418)	0.412
Firm delinquency	0.893	(0.320)	2.793***						
Fixed assets				0.534	(0.750)	0.507			
CEO age							0.394	(0.641)	0.378
Constant	9.915	(1.421)	6.979***	-22.044	(7.417)	8.833***	-88.627	(20.050)	19.540***
Obs.		326			326			326	
R-squared/ Log-Likelihood		0.370			57.959			50.691	

INTER1=Credit quality x younger firms; INTER2=Length x older firms
Standard errors are reported in parentheses. This study controls for industry (nine dummy variables) and organizational form (four dummy variables), but the results do not appear in this table. *** Statistically significant at 1% level. ** Statistically significant at 5% level. * Statistically significant at 10% level

represents the interaction of borrower credit quality and young firms. Information asymmetry is more likely among young borrowers, so using collateral to signal credit quality should be more frequent among young borrowers than older borrowers (Jimenez et al. [36]; according to a quartile split, young firms for this study have been in business for less than eight years. The second interaction variable (INTER2) refers to whether the bank charges high interest rates or requires more collateral (hold-up problem) by exerting ex post bargaining power over locked-in borrowers. The interaction features relationship length and older firms, defined as those that have persisted long enough to reach the third quartile (15 years) of the age sample.

The results in Table 5 indicate that the coefficient INTER1 is positive and statistically significant (1% level) in the PC equation (3.342) but is negative (-.627) and statistically significant (5% level) in the IRP equation. In the BC equation, the positive coefficient of INTER 1 (1.385) is not statistically significant, perhaps because young firms also tend to be small and suffer business collateral constraints (e.g., [32]; [54]). These findings confirm that collateral, especially PC, can reveal borrowers' types; high quality borrowers signal their real value and belief in the quality of the project by posting collateral, which enhances the quality of the credit request, according to the bank. The bank in turn charges a lower interest rate. In addition, PC provides a substitute for equity (especially for young firms), because the sale of personal assets can repay the loan (e.g., [17]).

The results for INTER2 in Table 5 are similar to those in Table 5. The negative collateral coefficients (BC -.246, PC -.187) confirm that relationship lending is a substitute for collateral requirements. Older firms with longer relationships pledge less collateral (see also [7] [17] [36]). However, the positive coefficient (.067, significant at 10%) in the IRP equation suggests that the bank uses loan interest rates as a loss leader to secure long-term rents in business relationships.

Table 5 also shows that, with collateral use endogenous in a simultaneous equation system, the IRP for firms required to post collateral is higher than that for firms that do not, similar to the results in Table 5. Thus the positive coefficient for the interest rate variable suggests that borrowers that pay higher interest rates are more likely to have collateral-based loans. This result matches John et

al.'s [37] theoretical demonstration that secured public debt has a higher yield than unsecured debt, due to agency issues between managers and lenders and imperfections in credit agency ratings. Reliable information on SMEs is rare and costly, so asymmetric information between borrowers and lenders is much higher. In turn, the IRP of collateral loans should be higher [17].

6. Concluding remarks

This study investigates if good borrowers offer collateral to signal their low risk type and earn a loan contract with a lower interest rate or if riskier borrowers simply must provide more collateral, considering the presence of varying borrower–lender relationship effects. The data from UKSMEF 2008 and a simultaneous equation approach reveal that debt term contracts depend on both elements. Borrowers that pay a higher interest rate also are more likely to provide collateral for their loan. Thus collateral appears to provide an incentive device to address moral hazard. Furthermore, high quality borrowers choose contracts with more collateral to obtain a lower interest rate, so collateral appear to act as an incentive to address adverse selection, in line with signaling theory. Personal collateral seems particularly effective as a sorting device: Good borrowers are more willing to put up collateral, especially personal collateral, which helps them avoid restrictions on their use of business collateral. For the lender, personal collateral also is more effective for limiting the borrower's risk incentives. In addition, personal collateral minimizes costly monitoring requirements [51]. The loan characteristics have implications for the cost of borrowing, such that borrowers pledge collateral to receive a lower interest rate and borrow more with long maturities. Regarding the borrower–lender relationship, the results show a substitution effect between relationship length and collateral requirements, though a long-term relationship also seems to have a positive effect on interest rate premium charges [42].

However, this study suffers some limitations. First, the data provide information only about whether the loan features collateral requirements or not (binary variable), without controlling for the scale of collateral provided [32]. Second, this study assesses the signaling role of collateral only indirectly, because no direct evidence of whether collateral is sought or offered is available in the data set. Third, the results indicate that that the strength of the borrower–lender relationship translates into an increase in the interest rate charged but also show a substitution effect with collateral. Further research should evaluate whether enhanced bargaining power for the borrower reflects hold-up or a strategy to mitigate budget constraints, which then increases the availability of credit to SMEs. Fourth, ample empirical evidence indicates that the loan market is highly segmented [5] and that market environment influences the credit risk assessment [48]. So, additional studies should control for market conditions.

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References

[1] Ang, J., Lin, J., Tyler, F. (1995). Evidence on the lack of separation between business and personal risks among small businesses. Journal of Small Business Finance. 4:197-210.

[2] Avery, R., Bostic, R., Samolyk, K. (1998). The role of personal wealth in small business finance. Journal of Banking and Finance. 22(6-8):1019-1061.

[3] Bank for International Settlements Basel II: International Convergence of Capital Measurement and Capital Standards: A revised Framework. Basel: BIS. 2004.

[4] Baas, T., Schrooten, M. (2007). Relationship banking and SMEs: a theoretical analysis. Small Business Economics. 27:127-137.

[5] Berger, A., Frame, W. (2007). Small business credit scoring and credit availability. Journal of Small Business Management. 45(1):5-22.

[6] Berger, A., Udell, G. (1990). Collateral, loan quality, and bank risk". Journal of Monetary Economics. 25:21–42.

[7] Berger, A., Udell, G. (1995). Relationship lending and lines of credit in small firm finance. Journal of Business. 68(5):351-381.

[8] Besanko, D., Thakor, A. (1987a). Collateral and rationing: sorting equilibria in monopolistic and competitive credit markets. International Economic Review. 28(3):671–689.

[9] Besanko, D., Thakor, A. (1987b). Competitive equilibria in the credit market under asymmetric information. Journal of Economic Theory. 42:167–182.

[10] Bester, H. (1985). Screening vs. rationing in credit markets with imperfect information. American Economic Review. 75(4):850-85.

[11] Bester, H. (1987). The role of collateral in credit market with imperfect information. European Economic Review. 31(4):887-899.

[12] Bester, H. (1994). The role of collateral in a model of debt renegotiation. Journal of Money Credit and Banking. 26(1):72-86.

[13] Boot, A. (2000). Relationship banking: what do we know? Journal of Financial Intermediation. 9:7-25.

[14] Boot, A., Thakor, A. (1994). Moral hazard and secured lending in an infinitely repeated credit market game. International Economic Review. 35(4):899-920.

[15] Boot, A., Thakor, A., Udell, G. (1991). Secured lending and default risk: equilibrium analysis, policy implications and empirical results. Economic Journal. 101:458–472.

[16] Bolton, J. (1971). Report of the Committee of Enquiry on Small Firms. Cmnd 4811 (London, HMSO).

[17] Brick, I., Palia, D. (2007). Evidence of jointness in the terms of relationship lending. Journal of Financial Intermediation. 16(3):452-476.

[18] Bricu, S., Capusneanu, S., Boca, I., Topo, D. (2014). Cost Analysis and Reporting the Performances of Companies in the Ministry, Proceedings of the 6th WSEAS International Conference on Applied Economics, Business and Development, Lisbon-Portugal, Oct30-1Nov 2014, pp.51

[19] Chan, Y., Kanatas G. (1985). Asymmetric valuation and the role of collateral in loan agreements. Journal of Money, Credit and Banking. 17(1):85–95.

[20] Chakraborty, A., Hu, C. X. (2006). Lending relationships in line-of credit and non-line-of-credit loans: Evidences from collateral use in small business. Journal of Financial Intermediation 15: 186-107.

[21] Chong, F. (2010). Evaluating the Credit Management of Micro – Enterprises. WSEAS Transactions on Business and Economics. 7(2):149-159.

[22] Coco, G. (2000). On the use of collateral. Journal of Economic Surveys. 14(2):191-214.

[23] Constantinescu, A., Badea, L., Cucui, I. and Ceausu, G. (2010). Neuro-Fuzzy Classifiers for Credit Scoring. Proceedings of the 8th WSEAS International Conference on Management, Marketing and Finance. 132-137.

[24] Cowling. M. (2010). The role of loan guarantee schemes in alleviating credit rationing in the UK. Journal of Financial Stability. 6:36–44.

[25] Craig, B., Jackson III, W. Thomson, J. (2007). Small firm finance, credit rationing, and impact of SBA-guaranteed lending on local economic growth. Journal of Small Business Management. 45(1):116-132.

[26] Cressy, R., Toivanen, O. (2001). Is there adverse selection in the credit market? Venture Capital. 3(3):215- 238.

[27] Degryse, H., Cayseele, P (2000). Relationship lending within a bank-based system: evidence from European small business data. Journal of Financial Intermediation. 9(1):90–109.

[28] Diamond, D. (1989). Reputation acquisition in debt markets. Journal of Political Economy 97(4):828-860.

[29] European Commission. Highlights from the 2002 survey. Observatory of European SME: 8.

[30] Greenbaum, S., Thakor, A (1985). Contemporary financial intermediation. Dryden Press, Fort Worth, TX.

[31] Han, L., Fraser, S., Storey, D. (2009). The role of collateral in entrepreneurial finance. Journal of Business Finance and Accounting. 36(3&4):424-455.

[32] Hanley, A. (2002). Do binary collateral outcome variables proxy collateral levels? The case of collateral from start-ups and existing SMEs. Journal of Small Business Economics. 18(4): 315-329.

[33] Harris, M., Raviv, A. (1991). The theory of capital structure. Journal of Finance. 46(1):297-335.

[34] Inderst, R., Mueller, H (2007). A lender-based theory of collateral. Journal of Financial Economics. 84: 826-859.

[35] Jensen, M., Meckling, W. (1976). Theory of the firm: managerial behavior, agency costs and ownership structure. Journal of Financial Economics. 3:305-360.

[36] Jiménez, G., Salas, V., Saurina, J. (2006). Determinants of collateral. Journal of Financial Economics. 81(2):255-281.

[37] John, K., Lynch, A., Puri, M. (2003). Credit ratings, collateral and loan characteristics: Implications for yield. Journal of Business. 76(3):371-409.

[38] Lehmann, E., Neuberger, D. (2001). Do relationship matter? Evidence from bank survey data in Germany. Journal of Economic Behavior and Organization. 45:339-359.

[39] Mann, R. (1997). The role of secured credit in small-business lending. Georgetown Law Journal. 86(1):1-44.

[40] Manove, M., Padilla, A., Pagano, M (2001). Collateral versus project screening: a model of lazy banks. Rand Journal of Economics. 32:726–744.

[41] Ongena, S., Smith, D. (2001). Empirical evidence of duration of relationships. Journal of Financial Economics. 61(3):449-475.

[42] Petersen, M., Rajan, R. (1994). The benefits of lending relationships: evidence from Small Business data. Journal of Finance. 49 (1):3-37.

[43] Rajan, R (1992). Insiders and outsiders: the choice between informed and arm's-length debt. Journal of Finance. 47:1367–1400.

[44] Rivers, D., Vuong, Q- (1988). Limited information estimators and exogeneity tests for simultaneous probit models. Journal of Econometrics. 39:347–66.

[45] Rosman, A., Bedard, J.(1999). Lenders´ decision strategy and loan structure decisions. Journal Business Research. 83-94.

[46] Sharpe, S. (1990). Asymmetric information, bank lending, and implicit contracts: a stylized model of customer relationships. Journal of Finance. 45:1069–1087.

[47] Smith, C., Warner, J. (1979). On financial contracting: An analysis of bond covenants. Journal of Financial. 7(2):117-162.

[48] Soares, J., Pina, J. (2014). Credit Risk assessment and the information content of financial ratios: a multi-country perspective. WSEAS transactions on business and economics. 11:175-187

[49] Steijvers, T., Voordeckers, W. (2009). Collateral and credit rationing: a review of recent empirical studies as a guide for future research. Journal of Economic Surveys. 23(5):924-946.

[50] Stiglitz, J., Weiss, A. (1981). Credit rationing in markets with imperfect information. American Economic Review. 71(3):393-410.

[51] Stulz, R., Johnson, H. (1981). An analysis of secured debt. Journal of Financial Economics. 14:501-521.

[52] Wooldridge, J. (2002). Econometric analysis of cross section and panel data. Cambridge, MA: The MIT Press.

[53] World Bank (2004). Review of small business activities. Washington, DC: World Bank Group

[54] Zambaldi, F., Aranha, F., Lopes, H., Politi, R (2011). Credit granting to small firms: A Brazilian case. Journal of Business Research. 64:309-315

Appendix 1 – Descriptive statistics and correlation

		Mean	Median	1	2	3	4	5	6	7	8	9	10	11	12	13
Interest rate	**1**	4.35	5	1												
Business collateral	**2**	0.36	0	-0.14**	1											
Personal collateral	**3**	0.21	0	-0.01	-0.24**	1										
Credit quality	**4**	0.58	0	-0.08	0.14**	-0.01	1									
Firm size	**5**	1,519,54	750,000	-0.22**	0.32**	-0.12***	0.09***	1								
Loan size	**6**	546,0730.6	750,000	-0.27**	0.29**	0.02	0.04	0.52**	1							
Loan maturity	**7**	9.62	12.50	-0.10***	0.20**	0.02	0.02	0.14**	0.26**	1						
Fixed rate	**8**	0.40	0.50	0.505**	-0.14**	-0.11***	-0.06	-0.15**	-0.19**	-0.19**	1					
Relationship length	**9**	14.50	10	0.04	0.10***	-0.03	0.13**	0.18**	0.13***	-0.01	-0.06	1				
Scope	**10**	0.55	0.57	-0.01	0.07	-0.02	-0.02	0.19**	0.13***	0.02	-0.02	0.16**	1			
Firm delinquency	**11**	0.22	0	0.20**	-0.08	0.01	-0.19**	-0.12***	-0.11***	-0.02	0.08	0.07	0.06	1		
Fixed assets	**12**	0.53	1	-0.07	0.19**	-0.07	0.11***	0.12***	0.09	0.13*	-0.06	-0.02	-0.02	-0.05	1	
CEO age	**13**	50.04	43.00	0.03	0.03	0.09***	0.09	0.13**	0.06	-0.02	-0.10***	0.26**	0.02	-0.06	-0.02	1

Appendix 2 – Univariate Tests

	Mean values by conditional sample								
	IRP≤ Median	IRP>Median	P-value	BC=0	BC=1	P-value	PC=0	PC=1	P-value
Dependent variables									
IRP				4.65	3.81	0.01	4.38	4.25	0.71
BC	0.38	0.30	0.20				0.42	0.13	0.00
PC	0.23	0.16	0.18	0.28	0.08	0.0			
Credit quality	0.58	0.57	0.82			0.01	0.58	0.57	0.95
Firm size	1,632,346	1,189,277	0.03	1,184,856	2,117,393	0.00	1,635,174	1,080,809	0.01
Loan size	583,888.9	435,361	0.00	469,342.1	683,141	0.00	544,767.4	551,029.4	0.90
Loan maturity	9.85	8.91	0.10	8.88	10.940	0.00	9.56	9.85	0.64
Fixed rate	0.26	0.80	0.00	0.45	0.31	0.02	0.42	0.29	0.05
Length	14.41	14.74	0.85	13.18	16.83	0.02	14.61	14.04	0.76
Scope	0.56	0.53	0.26	0.54	0.57	0.28	0.55	0.54	0.64
Instrumental									
Firm delinquency	0.17	0.33	0.00	0.24	0.17	0.15	0.21	0.22	0.90
Fixed assets	0.55	0.49	0.40	0.46	0.66	0.00	0.55	0.47	0.24
CEO age	48.06	47.99	0.97	47.51	48.99	0.35	47.26	51.00	0.04

A t-test applied to continuous variables; a chi2 test applied to binary variables. Ho: There is no relation between variables